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ABSTRACT

This report examines the state of computer based learning (CBL) in the Soviet Union based upon information gained during a visit to the Moscow Institute of Steel and Alloys, Moscow State University, and the Institute for Problems of Higher Schools. The visit had two aims: to study the political, educational, and technological pressures on CBL in the USSR, and to establish a channel for the continuing exchange of information about CBL between the UK and the Soviet Union. Specific topics examined include teaching programming; the role of statistics and economics in CBL; software philosophy; user support; information systems management; teaching foreign languages, chemistry, and physics; Institute role in innovation; CBL system development; automated dialog and corrective teaching; and information exchange. Nine summary conclusions and recommendations based on the visit are included. (CMV)

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COMPUTER BASED LEARNING IN THE SOVIET UNION – II

A report on a study visit to Moscow

November/December 1978

Organized under the terms of the Cultural Agreement between the British Council and the Soviet Ministry of Higher Education

N.J. Rushby
April 1979

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1. INTRODUCTION

During 1977 and 1978 it became clear that there was significant computer based learning (CBL) activity in the Soviet Union and that work had been going on in this area since the mid 1960s. The evidence for this came from a variety of sources, including the proceedings of a conference held in Kiev in 1968 (but not published in English translation until 1975), and discussions with visitors from Moscow in 1978 confirmed that considerable resources were still being devoted to these techniques. However, while it is relatively easy to obtain reports about CBL projects from North America and Western Europe, it has proved exceedingly difficult to get any information about corresponding projects in the Soviet Union. Nevertheless, the limited information which was available indicated that large numbers of students and staff were involved in computer based learning systems and that their approach to the problem was very different from that which we have adopted in the West.

Thus it was felt that there would be considerable practical benefits resulting from a visit to the Soviet Union to examine their use of CBL in more detail. Both the United Kingdom and the Soviet Union have invested heavily in CBL and a sharing of information and expertise could be expected to result in mutual savings and improved effectiveness. A study visit was arranged under the terms of the Cultural Agreement between the British Council and the Soviet Ministry of Higher Education whereby I would visit three institutions in Moscow involved in CBL. This is the report of that visit, which took place from Monday 27th November to Saturday 9th December 1978.

There were two main aims of the visit. First, I hoped to discover more about the way in which CBL is being developed and used in the Soviet Union. My enquiries concentrated on the political, educational and technological pressures on CBL, rather than on a detailed study of the content of specific learning packages. These pressures vary from country to coutry because different national educational systems present different educational needs. Even when a national need has been identified, the response cannot be certain. It depends on the value that is placed on education compared with other areas of national spending and on the way in which the education system is organised. Local institutional politics are invariably complex but are perhaps the most potent forces acting on educational innovation; success at working within the specific institutional framework is one of the keys to the long term viability of a CBL project. Within the institution, politics are often bound up with societal pressures and with local educational or training requirements. These pressures have been studied in a Western European and North American context (Hawkins 1977, Rushby et al 1978) and this visit was an opportunity to extend the study to the Soviet Union. I was therefore interested to find out what stimuli there had been for educational innovation at national and institutional levels and what responses had been forthcoming.

The second aim was to establish a channel for the continuing exchange of information about CBL between the UK and the Soviet Union. The CEDAR Project at Imperial College acts as a clearing house for information within the UK and already has strong links with similar projects in France, Holland, Germany and North America. I hoped to forge similar links with CBL projects in the Soviet Union, and also to investigate the possibilities for future exchanges of personnel under the terms of the Cultural Agreement.

References

Hawkins, C.A. (1977) "Computer Based Learning: A survey of factors influencing its initiation and development" Onderzoek en Ontwikkeling van Onderwijs, Rijksuniversiteit Utrecht, June 1977.

Rushby, N.J., James, E.B., and Anderson, J.S.A. (1978) "A three dimensional view of computer based learning in continental Europe" Programmed Learning and Educational Technology, 15(2), May 1978, Kogan Page, London.

2. SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

a) The initial reasons for Soviet institutions initiating CBL projects are varied. Most are due to local stimuli, for example a desire to try new teaching methods or to exploit a new pedagogical theory, but there is some suggestion that the pursuit of 'quality' as an aim of the current five year plan may have quickened teachers' interest.

b) Although there is some central direction provided by the Institute for Problems of Higher Schools in Moscow, most of the CBL work in the various universities and higher schools is uncoordinated, and so individual projects tend to be small and isolated. However, because of the sheer size of the Soviet education system and the number of educational establishments, there appear to be very many of these small CBL projects.

c) There is much more emphasis on the control of learning and on educational management information systems than in the United Kingdom. Where the computer is used as an integral part of the teaching process (as opposed to the management of learning), then the instructional form of CAL prevails over simulation or modelling applications.

d) The theories of learning developed by the educational psychologists at Moscow State University will have a considerable impact in their application to CBL, not only in the Soviet Union, but also in the United Kingdom. We should ensure that teachers and CBL developers in the UK are familiar with this work.

e) The main thrust of the technological work at the Institute for Problems of Higher Schools is towards the development of a large scale CBL system using purpose built terminals. While this has considerable attractions, it is an expensive, high technology solution and it would be disappointing if later it were to be discarded because of cost.

f) All the organisations visited agreed that there should be a better flow of information between the Soviet Union and the United Kingdom. It was arranged that the CEDAR Project should act as a clearing house for this information, and would be in frequent contact with CBL workers in the Soviet Union.

g) It was also agreed that there should be an exchange of journal papers on CBL with reciprocal publication, between the two countries.

h) It can take up to a year for a Soviet academic to make arrangements to attend a conference in the UK. Alas, they normally only receive six months notice of events like the ETIC conferences (Educational Technology International Conference) and CAL Symposia. We should endeavour to give more advance warning to colleagues in the USSR.

i) The cooperation should be strengthened by more visits between those developing CBL systems and carrying out research in related areas.

The original impression that our approaches to CBL are different yet complementary was confirmed by the study visit and further exchanges will certainly be of mutual benefit.

1. DIARY

Monday 27th November.
Outward flight London-Frankfurt-Moscow. Met by lecturer from Moscow Institute of Steel and Alloys and taken to University Hotel.

Tuesday 28th.
Most of the day was spent at the Institute of Steel and Alloys, arranging the programme of visits. After dinner, a visit to the Exhibition of the Economic Achievements of the USSR.

Wednesday 29th.
Institute of Steel and Alloys, Department of Engineering Cybernetics, introductory programming courses, the Computer Centre and the Department of Economics.

Thursday 30th.
A seminar on CBL in the United Kingdom to the Department of Engineering Cybernetics, followed by discussions and a working dinner.

Friday 1st December.
A seminar on CBL in the United Kingdom, language teaching in the UK with particular reference to English as a foreign language and finally the Hills and Coasts of Britain, to the Department of Foreign Languages at the Institute of Steel and Alloys. Working lunch with the Director of the Computer Centre. In the afternoon, a meeting at the Institute for Problems of Higher Schools and then back to the Institute of Steel and Alloys for a discussion about their computer managed learning system.

Saturday 2nd.
Cultural programme. Most of the day spent at the Tretyakov Gallery, followed by dinner and shopping.

Sunday 3rd.
In the morning, a walk round the University campus to Leninskii Gory. Later a visit to the Moscow Kremlin, dinner and a birthday party.

Monday 4th.
The morning was occupied by a detailed discussion of the computer managed learning system at the Institute of Steel and Alloys. In the afternoon and evening, meetings at the Faculty of Psychology, Moscow State University.

Tuesday 5th.
All day at Moscow State University, including a seminar on computer based learning in the United Kingdom.

Wednesday 6th.
The meeting arranged at the Institute for Problems of Higher Schools was cancelled owing to a surprise visit to the Institute by the Soviet and Polish ministers of Higher Education. Instead, shopping and then to the Institute of Steel and Alloys for discussions on computer assisted statistics teaching. Bolshoi Theatre in the evening.

Thursday 7th.
The planned visit to the Institute for Problems of Higher Schools was abandoned because of a gastric upset! The day was spent in bed.

Friday 8th.
At the Institute of Steel and Alloys. A film on study techniques followed by final discussions in the Department of Engineering Cybernetics. In the evening, a visit to the Moscow Puppet Theatre.

Saturday 9th.
The morning spent walking in the centre of Moscow. Then a farewell dinner and the return flight to London.

4. MOSCOW INSTITUTE OF STEEL AND ALLOYS

4.1. General description

The Moscow Institute of Steel and Alloys is one of the specialist Moscow institutes, offering courses in a variety of subjects, centred on the technology of steel and alloys. It has a student population of about 9000 FTE, the majority of whom are on full time courses. As might be expected, the proportion of female students is rather higher than would be found in a comparable UK institution. In its size and composition, the Institute is remarkably similar to Imperial College London.

Each year, all the universities and institutes in the USSR are assessed for their use of good teaching methods and for their return on research investment (the target is a five fold return on money spent). The institution that comes top of the league is rewarded, both financially, and with kudos. In 1977, the Moscow Institute of Steel and Alloys was awarded this distinction.

The Institute is divided into departments, such as the Department of Engineering Cybernetics (my hosts), the Department of Economics, the Department for Foreign Students (with many students from East Germany), and there is a central Computer Centre acting as a service unit. Although most of the courses are focussed on the technology of steel and alloys, the departments do have wider interests, and in the case of the Department of Engineering Cybernetics, perhaps 60% of their work is not directly concerned with the metallurgy.

The specialisation of the various institutes is quite marked and there was interest in the contrast between the Moscow institutions and the collections of colleges, polytechnics and so on in London, where similar courses are offered in many different places.

Students at the Institute either live at home with their parents or in heavily subsidised hostel accommodation which costs only a few roubles each month. The state pays for all their tuition fees and also provides a student grant. This varies between 15 and 50 roubles per month according to the student's academic achievement. Since the food in the Institute canteen is also subsidised, and books are very cheap, 16 roubles per month is sufficient for a student to get by, while the prospect of a larger grant provides a powerful incentive for academic improvement.

There was generally less evidence of audio visual support equipment in the Institute than one would expect in a UK establishment. Although slide projectors and 16mm film equipment were available, there was no sign of overhead projectors, of video facilities, or paper copiers. There was at least one automated classroom (language laboratory) in the Department for Foreign Students.

6.2. Academic organisation

While the Institute, as in other Soviet institutes, there is a considerable emphasis on the organisation of learning by the students, individually and in their classes. To this end, the Institute has made a 45 minute film called "How to Study" which is shown to all students in their first weeks of study. The film is expected to make a significant contribution to the way in which the students organise their work and their leisure.

The students schedule their time for work, in class and at home, for their cultural activities and for sport, in considerable detail. The timetable for each week is mapped out in advance and at the end of the week the student is urged to review how well - or badly - he managed to keep to the timetable. Thus, considerable self discipline, almost regimentation, is inculcated in the students. This is a marked contrast to the laissez faire of the UK university system.

A study commission, associated with each of the departments is responsible for the problems of academic study. The student is assigned to tutors who oversee his work and deal with any social (moral) problems. For the last three years of his five year course, he will stay with the same tutor.

The average weekly load for a student in the Institute is 60 hours, divided equally between classwork and homework.

There is a strong element of group self management among the students. Each class group of about 25 students appoints a committee of four:
- a group monitor,
- a student trade union representative,
- a young communist league representative,
- a student responsible for academic study.

The work of this group is monitored by the academic tutor who holds weekly meetings to discuss progress. Students who lag behind the rest of the class may be referred to the course director.

Assessment is by credits and examinations. At the end of the year the student has a brief 'viva' with each of his course tutors. A successful 'viva' results in a credit. If the student achieves a sufficient number of credits (about six) then he is allowed to take the examinations. Again, these are largely oral. There are about five examinations, each preceded by five days of preparation. Finally, at the end of his course of studies, the student is required to defend his diploma. Only if he is successful can he then proceed to do research as an aspirant.

4.3. Department of Engineering Cybernetics

4.3.1. Syllabus

The five year course for physics and chemistry students specialising in cybernetics and methodological processes, includes the following subjects:

- History
- Philosophy
- Political science
- Military science/ civil defence
- Foreign languages
- Physical culture
- Chemistry
- Physical chemistry
- Thermodynamics
- Heat flow mechanics
- Thermokinetics
- Metallurgy
- Graphical processes and representations of information
- Algebra
- Analogue computers
- Numerical methods
- Digital computers and programming
- Discrete mathematics
- Theoretical mechanics
- Theory of probability and statistics
- Discrete devices
- Economics
- Theory of management and organisation of systems
- Management information systems in industry
- Environmental studies and the use of natural resources

There are also specialist subjects such as:

- Professional course options
- Basis of ethics
- Basis of Marxist/Leninist ethics
- Mathematical modelling of metallurgical processes
- Mathematical modelling of industrial processes
- Mathematical modelling of management processes
- Scientific research

4.3.2. Computing provision

The Department of Engineering Cybernetics makes extensive use of the EC-1033 (similar to the IBM 370 series) in the Institute's Computer Centre, and also operates a number of smaller computers of its own. There are three NYERI-2 minicomputers which will handle small programs and are used as programmable desk calculators (although they are physically much larger).

The main interactive service for the Department is provided by an eight terminal Wang minicomputer system with both floppy and standard *exchangeable disc drives, a line printer and a drum plotter.* The system is used for computer science course teaching and for some CBL work. The programming is mainly in Wang Basic, the program text combining Basic reserved words, standard symbols, with remarks and output written in Russian. The resulting mixture is interesting, if a little confusing at first sight.

4.3.3. Teaching of programming

The introductory course consists of 32 hours of lectures and 32 hours of laboratory work, spread over one 16 week semester.

The choice of language for introductory courses is a subject of keen debate among computer science teachers everywhere. Should students be introduced to programming with an initial teaching language (like Basic or LSE) and then 'converted' to a more powerful language such as Fortran, should they forego a gentle introduction and learn Fortran ab initio, or should they be taught a procedural language such as Pascal or Algol 68? Although the use of Algol 60 and Algol 68 is traditionally strong in the Soviet Union, the Department teaches Fortran. This may be because of the orientation of the standard software and applications packages on the main Institute EC-1033. They adopted the initial teaching language approach because they felt it would be easier, and because it avoided the problems of using an American Fortran producing American error messages with non American speaking students. By the time that they move from their first language, the students are at least familiar with the concepts of programming and are happy to accept messages in English, writing their programs in a mixture of English and Russian. Thus, their first five exercises, run on the NYERI-2, use a language similar to Basic, oriented towards Russian.

There are three text books for the course, written by the Institute staff in 1975. Like most Soviet text books, they are very cheap by UK standards (30kp or about 25p each), and are available in the Institute library, or are given to the students. The course has a strong mathematical bias and assumes a very high mathematical standard. There was interest in the UK concept of non-numerical courses, not only for arts students, but also for those taking science and technology subjects.

The course starts with a two hour introduction to the Basic-like language for the NYERI-2. Then the students tackle the first exercises. The text book gives a complete solution with a flow chart and a sample program, and at this stage it is sufficient for the students to copy and submit that sample program. Such block schema and example programs are given as a guide for all but the last two exercises but it is expected that the students will produce their own solutions for all but the first two.

The students progress through the graded exercises:
- to find the roots of an equation by Newton's method,
- integration by Simpson's rule,
- to solve a differential equation,
- to calculate series in a given interval
  etc.

to the point where they are using loops, decisions, and complex input/output statements. In some cases there are many variants of each exercise, so that each student will produce a unique solution.

When they have completed the first five exercises, the student starts to learn Fortran. They repeat the last two exercises, producing new solutions, so that the algorithm is familiar and only the language is new. Still the problems are strongly numerical with some elementary algebra:
- calculate the spur of a matrix,
- multiply two matrices,
- find the maximum and minimum elements of a matrix,
- arrange the elements of a matrix.

In subsequent courses, the examples are more interesting and complex, involving problems from discrete mathematics and group theory.

The course teachers exercise firm control over the students' work. Each program is desk checked by the teacher before the student is permitted to submit it for running in the computer managed batch processing system. On average, a student will have four attempts at the program before he gets it correct. That exercise can then be signed off by the teacher and the student can move on to the next. The students keep exercise books containing their notes, narrative and listings of their solutions. There is generally more emphasis on the quality of programming than in the UK.

The batch testing of student programs on the EC-1033 is monitored by a computer managed learning (CML) system. The student's card deck is preceeded by a single control card which contains details of:
- the student's group number,
- the student's number within the group,
- the number of the program,

and specifies the function:
- read and save the program,
- make corrections to the program,
- change the input data for the program,
- execute the program again,
- delete the program and sign the exercise off in the student's record. This can only be used by the tutor.

The CML monitoring system brings two immediate advantages to the student. First, the student's test is controlled by a single card so the problems of job control language are circumvented. This makes it easier for the student to prepare his input. Second, it intercepts all the error messages emanating from the Fortran compiler and the

operating system, and translates them into Russian. This makes it much easier for the student to interpret his output.

Each time the student tests his program, the CML system records the fact. Periodically, the teacher requests a report which shows:
- the date of the report,
- the name of the teacher,

and then tabulates:
- the student's name,
- the exercises he is working on,
- the dates of his first and last tests on the exercise,
- the number of test shots,
- whether the exercise has been signed off.

For each exercise, it provides a summary showing:
- the number of students completing the exercise,
- the dates of the first and last test shots,
- the number of test shots,
- the number of correct results.

Finally it produces comparative tables on the results for all the teachers.

There was apparently no formal educational evaluation of the system, but the indications are that it is liked and accepted both by the staff and by the students. All the students in the Department of Engineering Cybernetics use the system, and those that do much of their work at home find it particularly useful. The students are kept informed by their teachers, of their progress as shown in their student record (although they do not know about the tables comparing the performance of different teachers) and it seems that they work better if they know that they are being controlled.

The CML system is perceived as controlling the teachers, as well as the students, and the output is used in peer appraisal among the staff and in discussions with the course director. It is accepted that the results for a given group depend, not only on the teacher, but also on the group itself. For example, a group of students who like mathematics are likely to do better than average. This may be a consequence of the mathematical bias of the examples. Then again, different teachers have different styles and work their students at different speeds. Therefore the statistics are used to give an overall picture and to help teachers with difficult groups, rather than to compare teachers with each other.

4.3.4. Statistics with CAL

The CAL Statistics package was developed jointly by the Faculty of Physics and Chemistry, and the Semiconductor Faculty. It aims to help students with the mathematical planning of experiments and can be used in a number of ways; the student can input his own experimental data, or can draw on data produced within the package to simulate experiments in metallurgy (for example corrosion and abrasion) and

other subjects. The problems, which are designed by the teaching staff and set up in the framework of the package, are intended to be non-trivial without making large demands on processor time. The package runs on the Department's Wang time sharing system and is used both for timetabled laboratory work and for independent work in the students' own time. Typically a student will work with the package for about four hours. Half of this time is taken up with explanations given by the teacher, but there are plans to supplement this with student notes so that the student can prepare away from the terminal.

The package is interactive, taking the student through a tutorial sequence in which he is required to select appropriate statistical methods to answer the questions he is posed. The student's inputs are mainly numerical, in response to menu selections or requests for data. He has the option of editing his data after entering it. There is a sophisticated built in assessment procedure which decreases the student's score each time he fails to correct a mistake. 'Hard' mistakes are penalised more severely than 'soft' mistakes and if his score falls below an acceptable level then the CAL session is ended with a message that the student should go away and learn the material (in his own time). If the student performs satisfactorily then the CAL package is empowered to sign off that piece of work.

There is a randomising procedure in the package to introduce a realistic error into the simulated experimental data, and to reorder the presentation of the tutorial questions and menus. Thus, the student can work through the package on several occasions and still have a valid assessment.

The Statistics CAL project started in late 1977 and the results are due to be published in 1981. A number of developments are still in progress. The system keeps records about students' performance on a floppy disc. However this procedure is not very successful and is to be rewritten. Ultimately it is hoped that the system will be moved onto the central Institute EC-1033 computer and that there would then be an automatic transfer of student records from the CAL package to the main ACY system (see section 4.6).

4.4. Department of Economics

4.4.1. Computing provision

The Department of Economics pursues an independent computing policy, operating its own time sharing system and running its own computing courses. It does not use the CML system for teaching Fortran (section 4.3.3.) but provides more conventional courses managed entirely by the teachers.

The interactive timesharing syste runs on two mini computers, one of which is a Hewlett Packard, and has 16 terminals switchable between the two processors. The switching system was developed by the

Department.

4.4.2. Economics with CAL

The use of CAL in the Department was the result of research work in economic modelling, encouraged by professional support from the Institute for Problems of Higher Schools. The decision to incorporate the CAL material into the curriculum was taken at departmental level by the Deputy Secretary and the professors, and then approved by the Institute.

The use of the computer to model economic systems now plays a significant role in their courses. They have developed about 30 student oriented modelling packages and together these constitute about a third of their specialist economics course. By UK standards this is a very large contribution to the course material. Each package consists of a CAL program with associated student notes. Students in the Department are also expected to write their own programs to explore economic phenomena.

There has been no formal evaluation of the project but the staff attitude is certainly enthusiastic.

4.5. Computer Centre

4.5.1. Computing provision

The main Institute computer is an EC-1033. This is a relatively small (by UK standards) system, modelled on, and compatible with, the IBM 370 series. At present there are very few terminals and the system is used almost entirely in batch mode. However, they are starting to install terminals for research use, for teaching computer science - and eventually for CBL.

There are, as yet, no educational computer networks, such as Metronet or Arpanet, in the Soviet Union. The Deputy Director of the Computer Cente estimates that the URRS is currently about five years behind the West with such developments. However, given their use of IBM compatible hardware and IBM software products, it is very likely that this gap will close rapidly.

The Centre provides a general service to the Institute, and also to a number of schools in the area who do not have their own computer facilities but specialise in the teaching of mathematics and computing.

Parkinson's Law, applied to academic computer centres, predicts that the users' work load will rise to exceed the capacity of the installed computer system. As the system capacity is increased, so the pressure on the users to use the resource efficiently is decreased. Undoubtedly, little attention is paid to program efficiency in many UK

computer centres and it was a salutory contrast to see the emphasis on program efficiency and excellence imposed by the more limited resources of the Institute. This was demonstrated by the extensive desk checking of programs by students and staff where, in the UK, the user would rely on the computer to discover his errors.

In the circumstances it was surprising that there was no formal accounting and control of the use of computer time. Instead the machine is run as a form of the open shop in which staff and postgraduate students hand their work directly to the data control clerk while other students submit their work through their teacher. The data control clerk then schedules the work. All data preparation, mainly card punching, is done by the Computer Cente staff, not by the users themselves.

4.5.2. Software philosophy

A major advantage of an IBM 370 compatible machine is that it enables the Institute to use a wealth of standard IBM software products. The reliance on IBM software pervades their software thinking and they are reluctant to use other software, even where this is easily transferable. Perhaps this is because of reservations about the level of support for non IBM products, or about the practicality of transfer.

4.5.3. User Support

Many UK academic computer centres incorporate a section to provide advice and guidance for users. Its functions may include running service computing courses, issuing documentation and operating a 'clinic' for users with computing problems.

Because of limited staff resources, the Institute Computer Centre does not provide such support for all its users but decentralises the service among the teachers specialising in computing. Thus, all information and counselling comes from these teachers who will only contact the Computer Centre about those problems they cannot solve themselves. It is not clear whether this presents difficulties for the users, but it certainly set the Centre at a distance from most of those who use it.

4.5.4. CAL activity

With the prospect of procuring terminals for general student use, the Computer Cente has started to investigate the possibilities of CBL and, following its philosophy of adopting IBM products, has implemented the CAL author language Coursewriter III. Some physics teaching material has been prepared for evaluation with the system

Coursewriter III is the only author language that has come to their attention, and interest was expressed in Planit, LAL (Leeds Author

Language) and STAF (Science Teachers' Authoring Facility).

4.6. Educational Management Information System (ACY)

The use of a computer based management information system is commonplace in Soviet industry (as it is in most developed countries) and so it was a natural development to employ such systems in educational institutions. Although some Western educationalists would regard this as strengthening the role of 'education as an industrial process,' an educational management system (the Russian acronym is ACY) is a useful support for the close control that teachers in higher education exercise over their students' learning.

ACY systems are widely used in the Moscow institutes and the State University and in many other educational institutions. However, unlike the cooperative projects that produced the UK universities and polytechnics (UCIPA) systems and the CAMOL (Computer Assisted Management of Learning) system, the Soviet ACY systems have been developed individually on the initiative of the educational managers concerned. Since the systems address similar problems, most of the systems have similar characteristics.

The development of the ACY system at the Institute was instigated by the Sub-Rector. Its operation is the responsibility of an ACY section within the Department of Engineering Cybernetics.

The ACY system is used in the management of all the students in the Institute on all their courses. It is comprised of approximately twenty subsystems, most of which are interconnected so that they can share and exchange data. Some of these subsystems deal with:

- long term student records,
- class attendance,
- continuous assessment,
- examination processing,
- health records,
- sports records,
- financial control.

The first subsystem was developed to maintain a collection of biographic student data including details of their date of entrance, their group and course and their movements between groups and courses. This subsystem is run twice each year. At present, the data is captured on forms issued by the Administration Department, but there are plans to develop an automatic data collection method. The later subsystems were then designed to link into the student record system.

A second subsystem addresses the problems of continuous assessment, keeping records of the marks that students receive, and their class attendance with reasons for absence. The system integrates data collected on optically mark read cards, at group, course and faculty levels, and produces selective reports at appropriate levels for

different members of staff.

A third system, for 'programmed control,' is popularly called 'the five minute control system' because it collects and processes the results of short diagnostic tests held in the final five minutes of a class period. The teacher can administer a short multiple choice question test and the student responds on a card which is optically mark read. The tests are currently devised and encoded by the teachers. Sophisticated scoring techniques allow variable scoring, omitted questions and questions with no correct answer. This subsystem is being developed to provide test analysis, item banking and computer assisted test construction to produce equivalent tests for repeat testing. It is also being extended to cover the students' homework.

Most of the courses in the Institute are of the linear, lock step form and do not employ branching or stellar structures. Thus, there is no need for a system to direct students through complexes of course modules on the basis of diagnostic prescriptions.

The CAL packages developed by the Department of Economics (section 4.4.2.) can be regarded as a subsytem of the main ACY. They have been arranged so that they pass records of the students' continuous assessment results to ACY automatically. These records contain information about the work that has been completed; a flag to indicated that the exercise is finished, and sometimes a quantitative mark.

Each week, the group tutor receives a report about the general progress of his group. This is not only an informative report; parts of it act as a turn round document on which the tutor can enter new data for the ACY system. One part is the attendance record and it is the responsibility of the group monitor to take this to each class, until at the end of the week the attendance information can be added to the main student records.

The tutor uses the report to inform himself about the progress of the group as a whole and to identify those students who have problems. There are a number of standard courses of action that he can follow in such cases and having made the decision he records it on the turn round document so that too is added to the ACY files. This leaves the tutor in control of the remedial action - by indicating the weak students the ACY system enables him to manage by exception. The tutor can choose to select the student for inclusion in the report which goes to the Course Directors' meeting at the end of the month. Again, the system produces a suitable report for management by exception.

Information from the ACY system is available to anyone who needs it, provided that their request is authorised. This gives reasonable security against improper use although they do not have to abide by the consideration for privacy of personal data which impact on student

record systems in Europe and North America. Whereas, students in the West are keenly aware that records are kept about them and are concerned about the accuracy and sensitivity of their contents, there was no indication that their counterparts in the Institute were worried by these issues.

The primary use of the ACY records is for the day to day, week by week management of the Institute. They are also being used for research work. One current project is correlating the sporting activities of students with their academic achievements. Among other results, this work has indicated that boxers are better students than skiers.

5. MOSCOW STATE UNIVERSITY

5.1. Academic organisation

There were many similarities between the academic organisation of the Moscow State University and the Institute for Steel and Alloys. The staff student ratio of about 1 to 8 or 9 compares favourably with that found in most provincial universities where it is more usually 1 to 13 or 14. This enables the State University to operate a tutorially based teaching and pastoral system which is reminiscent of Oxbridge. The strong student tutor bonds are reinforced by weekly meetings to discuss the student's work. These are held in a 'climate of struggle' where the student is required to defend his work against the criticisms of his tutor. Students will spend the first five or six years at the University in preliminary studies, and about 20% will continue for a further three years to prepare a thesis for their degree.

As in the Institute for Steel and Alloys, the students are organised into groups, each with a small student committee. However in the State University this committee only has responsibility for organisational matters and not for academic progress. Nevertheless there is some peer review among students in informal groupings.

Examinations at the State University are mainly oral, but incourse assessment is often on the basis of written papers. If the students are successful in their course work, then they are permitted to take the oral examination which will typically last for 20 minutes and may be of the open book type. There is some use of multiple choice question (MCQ) question tests, particularly where the testing is carried out with teaching/testing machines, perhaps as a post test after a lecture. MCQ tests are considered to be useful for covering wide areas of the syllabus but are limited in their ability to provide deep testing.

The Faculty of Psychology, which is concerned specifically with educational psychology, offers a 30 hour course on study techniques. This aims to help the student to learn in a more systematic way. This kind of course is not universal in the USSR but is becoming more common and many institutions are now developing courses ranging in length between 5 and 50 hours.

The course at the State University is only in its first year, but early results have been favourable and it is already considered to be a success. The syllabus includes:

- how to get information,
- how to listen,
- how to read,
- how to use libraries,
- how to organise information,
- how to memorise information,

- how to reproduce information,
- habits of using information,
- how to think clearly,
- how to deduce the specific from general information,
- problem solving.

The material in this course is novel to the student and is based on actual examples taken from different disciplines rather than on educational psychology theory.

The academic work of the State University is controlled by the Teachers' Council which is part of the official University structure and includes the deans of the faculties. The balance of courses is determined by this Council. Teachers must persuade their colleagues that their courses are necessary and bargain for an allocation of time out of the students' overall studies. Research activities are similarly controlled by the University Research Council.

By UK standards, the audio visual (AV) facilities at the State University were limited. For example, a slide projector was not a standard piece of equipment in lecture theatres but was provided only on special request. While few institutions in the USSR have comprehensive AV facilities, most of them have some equipment and the situation is improving. As in the UK, there are problems in helping the teachers to make effective use of the equipment that is available and to prepare good materials.

5.2. Innovations in teacher training

The system of teacher training in the Soviet Union has some similarities with the UK system. Most of the teachers in Soviet secondary schools are trained in pedagogical institutes, while a minority follow a university course. However, in order to teach in a higher school, an institute or a university, the student should take a special course with an emphasis on educational methods. This course, of about 100 hours, is an integral part of the three year degree studies that follow the first five undergraduate years. It includes some educational theory, microteaching and teaching practice. This last is not only assessed by the staff, but also by the students who are on the receiving end of the teaching practice. The final degree examination covers the specialist subject syllabus and also includes the teaching studies. Since it is almost impossible to teach in an institute or a university without a degree, this usually ensures that all the teaching staff will have had some relevant training. Teaching methods are also included in postgraduate courses.

Nevertheless, there are still problems with training teachers for higher education because there is a lack of specialists in pedagogical training. Research in educational psychology and methodology has in the past been focussed on secondary, rather than on higher, education. The foundation of the Institute for Problems of Higher Schools in 1971 was one response to this problem. There are some postgraduate courses

for teaching in higher education, aimed at subject specialists who can study teaching methods for one or two years before preparing a dissertation on a pedagogical subject. The Faculty of Psychology runs courses in pedagogics for the University staff, producing teachers who are specialists in their own subject first and teachers second. All these courses are used to disseminate innovations in teaching methods.

All teachers in higher education have the opportunity of undertaking a four month inservice refresher course every five years. For university teachers these courses are provided by the universities at Moscow, Kiev and Leningrad, and similar schemes are operated for teachers in the polytechnics and institutes. The courses contain a mixture of specialist subject material and teaching methods, and aim to provide a complete update for the teachers. This strategy appears to work well.

Within the State University, the Faculty of Psychology works with staff in other teaching departments to develop and promote new methods of teaching. The theoretical and research input is provided by the Psychology staff while the practical implementation is carried out by the subject specialists. This brings the dual advantages of developing high quality teaching materials and diffusing knowledge of the new techniques throughout the University. One possible disadvantage is that the system imposes some uniformity of approach - all the materials are developed along the lines of Soviet psychological thinking - with the attendant risk that some possibly fruitful techniques may be left unexplored.

5.3. Research in the Faculty of Psychology

Teaching staff in the Faculty of Psychology work for about 1600 hours each year. Half of this time (800 hrs) is taken up with teaching and student contact time, a quarter (400 hrs) is set aside for preparation, while the remaining quarter (400 hrs) is devoted to research. Although this makes research a secondary activity, as in UK universities there is little reward for excellence in teaching, and so their research work is important to the staff. This can be contrasted with the situation for research staff in the universities and research institutes who have little or no teaching commitments and so can spend all their time in research.

The programme of research in education at the Faculty of Psychology started in the early 1950s. Building on behaviourist theories and the work of Galperin, the work now applies the general theories of cybernetics to education, so that general theories of control form the theoretical basis for teaching. The realisation of practical techniques also involves the psychological aspects of learning theory and, by marrying the two, it should be possible to construct a general model of the learning process. Within this framework, staff at the State University have created, sometimes spontaneously, a large number of different techniques. The problem now is to discover how to use

these effectively.

The teaching process is a system which involves the teacher, the student, and various aids or objects with which the teacher and/or the student can interact. These aids can be divided into three groups.
First, those aids which help the teacher, by providing the student with information, recording his responses, or controlling the learning process.
Second, those aids that directly help the student.
Third, those aids that represent objects with which the student can interact, for example computer simulations or models.

The course content - what should be studied - is seen as a very important component in this system. What knowledge must the student acquire (and what is knowledge anyway), how will the student be required to use this knowledge, and how can it be presented so that the student can solve generalised problems? They believe that a key step is to reduce the vast amount of subject material to a manageable size, by discovering rules and applying systematic methods. For example, the 250 rules governing Russian pronunciation can be simplified to three general principles. Similar techniques are being applied to other subjects - chemistry, mathematics and foreign languages. Generalised models and methods of thinking can also be used to shorten the course content without loss of information. This provides longer term benefits because, by creating a theoretical framework for their knowledge, it makes it easier for the students to continue learning their subject after the end of the course. For example, it is claimed that a generalised method of thinking about languages has made it easier to teach students how to translate from any foreign language into Russian. In the early stages, the information must be externalised and available to the students in some material, perhaps verbal, form.

In the West over the past few years, the individualisation of learning so that students can work at their own pace through materials tailored to their individual needs, has become increasingly important. Although this importance is realised by the faculty staff, they feel that in general, Soviet educational institutions are not yet ready for it. While a teacher will make a diagnosis based on a student's performance and aspirations, there is no educational theory behind any individualisation. There are also dangers in giving the student complete freedom because he may not make the "best" (that is, as judged by his tutor) academic choice. The feeling is that it is (or should be) the teacher who is in control of the learning and, although there is some ongoing research in this area, the philosophy of an external locus of control in learning is very pervasive.

There has been, and still is, considerable use of teaching machines in the USSR, but the State University now considers these to be an obsolescent technology, although by saving the teachers' time they are better than nothing. Their aim now is to develop a machine which will

solve the problems of teaching in an economical way. One signpost to the way ahead is the Illinois/CDC Plato system. They believe that this kind of system has never been fully exploited and could probably satisfy most of their didactic requirements. Were such a system available to them then they would make greater and deeper use of it.

Their present teaching machines and CAL systems are limited in their ability to control learning. They believe that it is necessary to use sophisticated systems even though these are most expensive and so less readily available. The student interface must be as natural as possible: if the student has to deal with a primitive computer then the additional actions that he has to carry out disturb his concentration and impair his learning. An intelligent system is needed to analyse the student's responses and to get closer to the way in which a teacher would react to the student's behaviour. An obvious problem here is in handling typing errors without rejecting or misinterpreting the response. Rejected responses can distress the student.

The presentation of information to the student is one of the functions they wish to automate and they believe that a multimedia terminal (perhaps like some of the early Plato terminals or those being developed in West Germany) is the optimal solution.

Computer based learning is not accepted uncritically by the teachers and they have many reservation, even about sophisticated systems like Plato. But, their criticism does not lead to wholesale rejection; if a CBL system fulfils a useful function then it is worth using. The power of the computer system is considered of less importance that what teachers can do with it.

5.4. Teaching of foreign languages

Until fairly recently, the State University taught most foreign languages in the traditional method that dates back to the 17th century. There has generally been less use of audio visual materials than in the West, for example language laboratories are not readily available. Over the past few years the foreign language teachers have, in cooperation with the staff of te Faculty of Psychology, developed a large coherent programme for teaching expressive (composition) and impressive (reading) use of foreign languages, based on the work of Galperin. This programme is used both for the teaching of language specialists and also for teaching service courses to non-specialists. While the material is currently presented and managed by the teacher, it has been organised in such a way that it would be a relatively simple matter to incorporate it into a CBL package.

The programme of expression aims to teach the student how to construct (whether writing or speaking) all the possible phrases in the foreign language. Since it is clearly impossible to teach an infinite number

of phrases, the developers have used an extension of Chomsky's conceptual categories to create a series of invariants at a deep level. The teaching strategy is based on a theory of activity, specifically on the step by step formation of intellectual actions. Each of the invariants deals with one kind of syntactic structure with particular characteristics, for example real or imaginary subjects or objects.

The students are helped by their teacher to build up models of the invariant phrases and then to combine them to form more complex phrases and sentences. They are supplied with the necessary vocabulary, already declined and conjugated as required, and use their sentences and the vocabulary for translation and speech exercises.

This algorithmic method - the teachers call it 'learning by rules' - is held to be applicable for forming all types of sentences and for the teaching of all foreign languages - Russian, German, English, Japanese etc. In contrast to the traditional method, it is highly theoretical and concentrates very much on the syntax of the language, perhaps to the detriment of the semantics. The work is currently at the experimental stage but seems likely to become the standard method of language teaching.

The programme of impression aims to teach the student how to read a foreign language. To do this, the student must be able to recognise the orienting moments within the text and the syntactic structure about these points. The technique involves teaching the student the various verbal forms and the position of the form within the sentence. Again, this is simplified by the use of invariants. The student divides the text into parts, identifies the structure in each part and then completes his translation by using the vocabulary provided

5.5. Teaching of chemistry

The Chemistry Faculty runs a service course for physicists and geologists which aims to teach them chemical theory in an interdisciplinary way. This has proved to be a much more difficult task than imparting the traditional, more factual knowledge about chemistry. Thus it was agreed that the chemistry staff would cooperate with the psychology staff to produce a new course which would overcome these problems.

Because the students' timetable could not be disturbed, the new course is the same length as the old, and consists of about 70 hours spread over three years. There are some 17 hours of lectures with the remainder made up of seminars and laboratory work.

The key to the new course is the structuring of the learning material so that the students, helped by their teacher, can orient themselves to think about chemistry in a systematic way. Again, the theories of Galperin and Talyzina have been used to develop various activities for

different types of orientation, and the course is now based on the concept of chemical substances as a unified system.

The subject is built up as a series of levels and the teaching shows how the organisation at each level builds on the level below. First the students consider the structure of matter at a sub-atomic level, then at an atomic and finally at a molecular level. The chemical structure of compounds follows from the molecular structure.

Chemical dynamics are developed from the steady state so that the students can understand reactions in gases, solids and liquids. Again, chemical reactions are presented and studied as a system and there is extensive use of invariants to reduce the quantity of subject material to be learned. A large part of traditional courses is concerned with the description of chemical compounds but, by using invariants, this has been reduced to only two hours of the 17 hour lecture component. Once he has mastered the invariants, it is claimed that the student can determine the construction and the features of all chemical substances.

Unlike many new courses, the content of this new course is broadly the same as the old - only the organisation has been changed. So it has been possible to carry out some statistical evaluation by means of pre- and post-tests with experimental and control groups. These indicate that the new course is more successful. They are now investigating the extension of the method into other chemistry courses and into other departments. In the academic year 1979/80 it is planned to use some of the material in technical engineering studies.

5.6. Teaching of physics

Another area of cooperation between specialist teachers and the psychology staff is in the Faculty of Physics where the course in introductory mechanics has been revised in accordance with the new methods. The course is now in use and it is claimed to be dramatically more effective than its predecessor, although the evaluation work is not yet complete.

The traditional approach to mechanics is perceived as one which moves from simple to more complex notions: in the new course this strategy is reversed. Mechanics, as a scientific subject, is determined by a finite number of basic concepts which then form the basis of all the mechanical phenomena that must be understood and learned. These basic concepts are the teaching invariants of the course.

In the first stage the student is given definitions of the basic concepts of mechanics. The second stage moves from the qualitative definitions to the quantitative aspects, special relationships, and introduces such laws as the conservation of energy. This leads to the system of units. In the third stage, the students combine the qualitative and quantitative characteristics, building mathematical

and graphical models of mechanical systems, and in the final stage they progress to general problem solving.

6. INSTITUTE FOR PROBLEMS OF HIGHER SCHOOLS

6.1. General description

The Institute, which was founded in 1973, carries out research and development in all aspects of higher education, including curriculum development, methods, and hardware aids. It provides some coordination between research projects located in universities and other institutes and also has various projects of its own. There is an information service which is responsible for a number of publications and for abstracting journals from the USSR and overseas. The Institute is in many ways analogous to the French Institut National de Recherche Pedagogiques and has no direct parallel in the UK. It combines uner one roof, many of the functions of the UK Councils for Educational Technology (CET, SCET and NICET), some of the work of the Schools Council, and research and development work carried out in UK schools, colleges of education and institute of educational technology.

The Institute is organised as a number of departments:

- Theory and methods of education,
- Scientific organisation of the educational process,
- Organisation of scientific research,
- Communist education of the student body,
- Problems of economics of higher education,
- Future of higher education,
- Educational management information systems (ACY),
- Problems of specialist education,
- International teaching of specialists,
- Scientific information,
- Calculational technology (which is concerned with CBL).

6.2. The role of the Institute in innovation

The Institute has close contacts with all the other reasearch and teaching institutes and acts as a centre for information about educational media and methods, but its influence appears to be that of guiding, rather than prescription. In some cases the innovation developed at the Institute is taken up by others, while new ideas developed at other institutes are examined and often promoted by the Institute. An innovation which is supported by the Institute for Problems of Higher Schools is not guaranteed success, but will at least be given serious consideration by other institutions.

6.3. CBL system development

The responsibility for computer based learning rests with the Department of Computational Technology. The Department has made a study of some of the systems used in the UK and North America, and from this basis is now developing a new integrated and sophisticated CBL system. The work should be completed in 1980.

The new system will run on standard computer systems (for example the EC-1020 and EC-1033 at the Institute) but will use special purpose alphameric terminals developed from the standard commercial terminal design. This will not allow full graphics but will enable the CAL package to build pictures using special character techniques.

The main design aim is to produce a very flexible system in which both the hardware and the software are easy for the teachers to understand. Thus the teachers will use a new CBL author language to interact with the system.

They see two aspects to computer based learning. First, the system can provide information to the student. The student holds a dialogue with the system to obtain information, either explicity, or in the form of models, simulations and so on. The system may suggest that he should consult other people or other media. In this way the CBL system draws together the whole range of media. Aquiring, organising and storing all this information is a significant problem and the team are investigating different ways in which the teacher can set up information or build information models, for example simulation, in the system. Trial materials have been written in mathematics and physics. Ideally they would like the teacher to be able to use a single technique to set up all his packages.

The second aspect concerns the control of learning and instructional strategies as the student works through the package, and on longer time scales. Their experience with programmed learning has only limited relevance here because of the extended range of media that the new CBL system will bring together. It would be reasonable to extend this control and gathering of information about the students' performance and progress, to link in with existing educational management information systems (ACY).

7. SYSTEM FOR AUTOMATED DIALOGUE AND CORRECTIVE TEACHING (SADCO)

The SADCO system was originally developed by the Technical Institute for the Automobile Industry in Moscow, but has now been implemented in a number of other institutions including the Moscow State University where it is running on an EC-1020 computer.

The student works with SADCO via a small visual display unit which has a touch sensitive screen, and a tape recorder and projector controlled by the system. The educational psychology staff at the State University regard SADCO as too limited for large scale teaching but have found it useful as a research tool, particularly in investigations of multimedia presentation and the recognition of students' responses on the touch screen. The system is still undergoing development and appears to be contributing to the design thinking for the new CBL system at the Institute for Problems of Higher Schools.

8. INFORMATION EXCHANGE

8.1. CEDAR Information Service

One of the main aims of the visit was to establish channels for the continuing exchange of information about CBL between the UK and the USSR. The CEDAR Project at Imperial College has developed an information and advisory service, whence teachers in the College and from other organisations can get assistance with computer based and computer managed learning. Although originally developed for the College itself, the Information Service which is unique in the UK, has been made generally available to all educational and training organisations. The information service provided by CEDAR is founded on two databases held on the main College computer, which hold details of books, reports and papers on computer based learning and related topics, and details of computer assisted learning packages available in the UK. These catalogues are published in microfiche, together with a keyword in context (KWIC) index, and can be searched on-line using a computer terminal and a simple enquiry program. Many of these books and reports are held in the CEDAR collection in the main College library and are available on loan to members of the College and other libraries.

There was considerable interest in this service from staff in all three of the institutions visited and it was agreed that they should be able to use the facilities to investigate any specific enquiries they might have in the future. In addition it was arranged that the CEDAR Project should send copies of any reports that might be of interest, notices of conferences etc, on a regular basis to correspondents in each of the institutions.

There was some discussion about the possibility that a similar information system might be set up in the Department of Engineering Cybernetics of the Institute for Steel and Alloys. There was particular interest in the idea of a computer based index of CBL packages available in the Soviet Union.

8.2. Journal exchange

There were discussions in all three institutions about exchanging papers on CBL for publication in the UK and the USSR on a reciprocal basis. Key papers written and published in the UK would be exchanged for key Soviet papers, with the translations carried out by the receiving country to ensure an accurate idiomatic style. The idea was well received but progress is realising such a scheme is likely to be slow.

It is hoped that there will be a special issue of the Journal 'Programmed Learning and Educational Technology' devoted to educational technology and computer based learning in the Soviet Union. This would be edited jointly by Nick Rushby (Assistant Editor

of PLET) and by a colleague in Moscow. Again there was agreement in principle but there are likely to be some difficulties and slow progress.